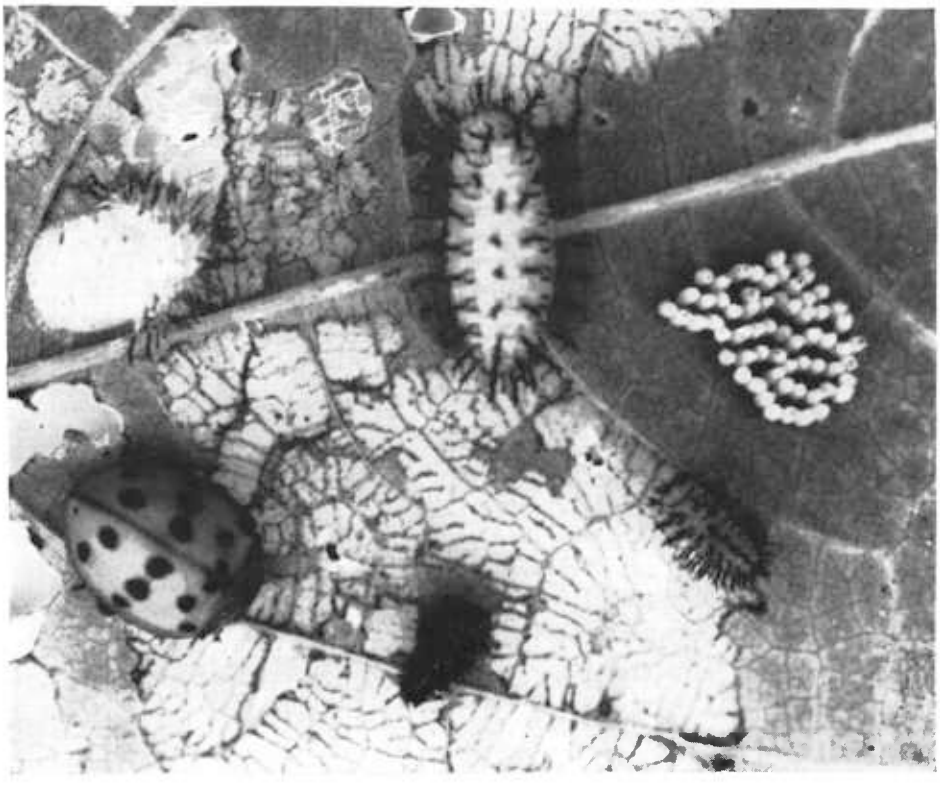
the Mexican Bean Beetle in the East and Its Control



Farmers' Bulletin No. 1624
U. S. DEPARTMENT OF AGRICULTURE

Figure 1.—Eggs (*a*), larvae (*b*), pupa (*c*), and adults (*d*) of the Mexican bean beetle in natural position on the under surface of a bean leaf. Enlarged.

Washington, D. C.

Revised October 1953
Slightly revised January 1956

THE MEXICAN BEAN BEETLE IN THE EAST AND ITS CONTROL

Prepared in the Entomology Research Branch, Agricultural Research Service.

CONTENTS

THE MEXICAN BEAN BEETLE [1] is the most serious insect enemy of beans in those parts of the United States that it inhabits. It has long been present in the Southwestern States. In 1920 it was discovered at Birmingham and Blocton, Ala. Since that time the pest has spread throughout the greater part of the country east of the Mississippi River as well as bordering areas to the west.

APPEARANCE OF INSECT AND NATURE OF DAMAGE

The Mexican bean beetle is a copper-colored, round-backed beetle with 16 black spots on its back. It is about ¼ inch long and about ⅛ inch wide (fig. 1, *d*). The beetle resembles some of the native beneficial ladybirds.

The larva, or immature form, is orange-colored, varies in length from about 1/20 inch when young to about ⅓ inch when full grown, and is covered with branched spines, which give it a fuzzy appearance.

[1] *Epilachna varivestis.*

260168°—53

Injury done to the bean plant by the young and adult of the Mexican bean beetle is different from that caused by other insects which feed on the beans. The adult, feeding from below, eats ragged areas in the lower surface of the leaf, but often cuts through the upper surface, giving the foliage a lacelike appearance (fig. 2). The larvae also feed on the under surface of the leaf, but do not cut through the upper surface. The lower tissue is scraped up and compressed by the mouth parts as the juices are swallowed. The solid material is left on the leaf in small windrows or strips, so that the result is a peculiar network characteristic of the work of this insect (fig. 3).

Figure 2.—The under side of a bean leaf showing areas eaten by the adults of the Mexican bean beetle. Enlarged.

The leaves are attacked first, but both beetles and larvae will feed on the young pods if the leaves have been destroyed or have become tough and unpalatable. They may even eat the stems. When insects are numerous, an injured plant appears completely dried out.

THE DIFFERENT STAGES

The Mexican bean beetle reproduces by means of eggs deposited in clusters of from 40 to 60 on the lower surface of a leaf. Figure 1 illustrates the different stages of the insect. The eggs are orange yellow. The young, or larva, when first hatched, is about $\frac{1}{20}$ inch long, and a few hours after hatching it begins feeding. As it grows, the larva molts or sheds its skin. When full grown it is about $\frac{1}{3}$ inch long and about half as wide. The full-grown larva attaches itself to

the under surfaee of the bean leaf upon whieh it has been feeding or to some other leaf, weed, or nearby object, and becomes shorter but larger around the body preparatory to pupation.

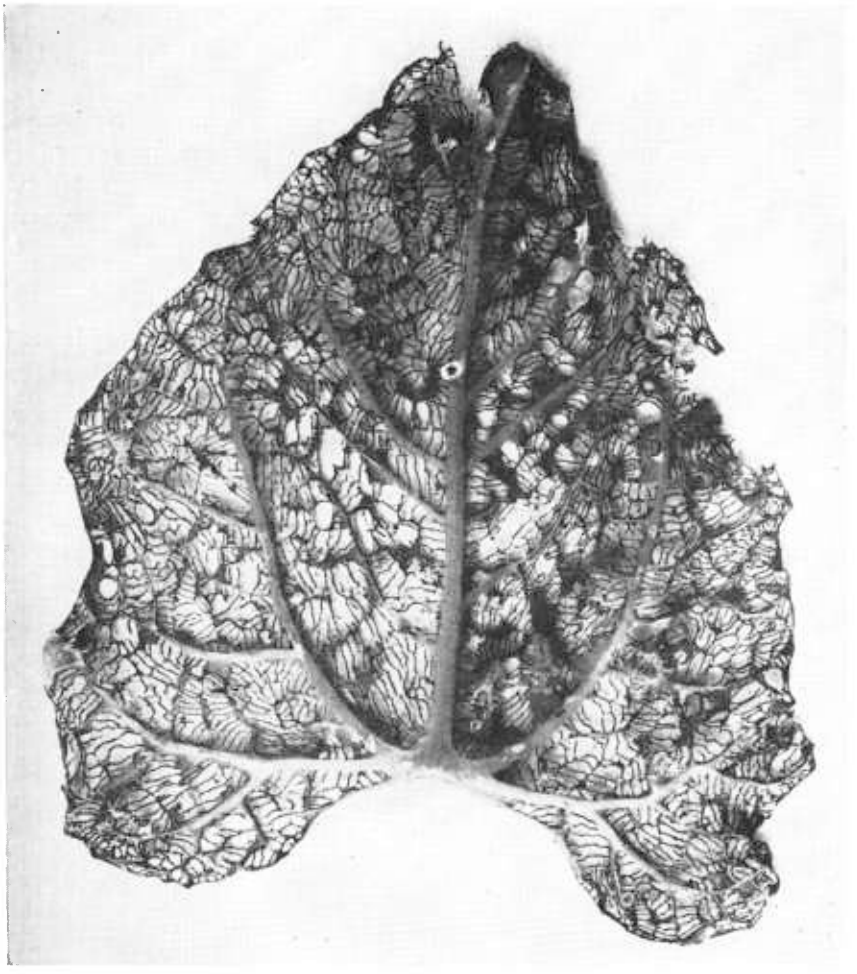


Figure 3.—Results of the feeding of larvae of the Mexican bean beetle on a bean leaf. Enlarged.

It then ehanges to the pupa, or inactive stage, which is orange colored, and is attached to the leaf or other objeet by means of the fourth larval skin. When the beetle develops from the pupal stage it is light-lemon colored and shows no blaek spots upon the wing eovers. The spots soon appear, however, and the beetle gradually becomes darker until after a week or 10 days it has become eopper eolored. Old beetles and those that have lived through the winter are darker in color, and the spots are less distinct.

Figure 4.—Unsprayed beans to the left of stake; sprayed beans to the right.

Figure 5.—Mexican bean beetle damage to snap beans. The sprayed rows on the right are not damaged, but the unsprayed rows on the left are defoliated.

REGIONS IN WHICH THIS BEETLE IS FOUND

Probably the Mexican bean beetle came originally from Mexico. It has been known in the western part of the United States since about

1850. It is now known to exist in Arizona, New Mexico, Colorado, Wyoming, Utah, Texas, Nebraska, and South Dakota. An isolated infestation was found in Ventura County, Calif., in 1946, and another in Twin Falls County, Idaho, in 1954.

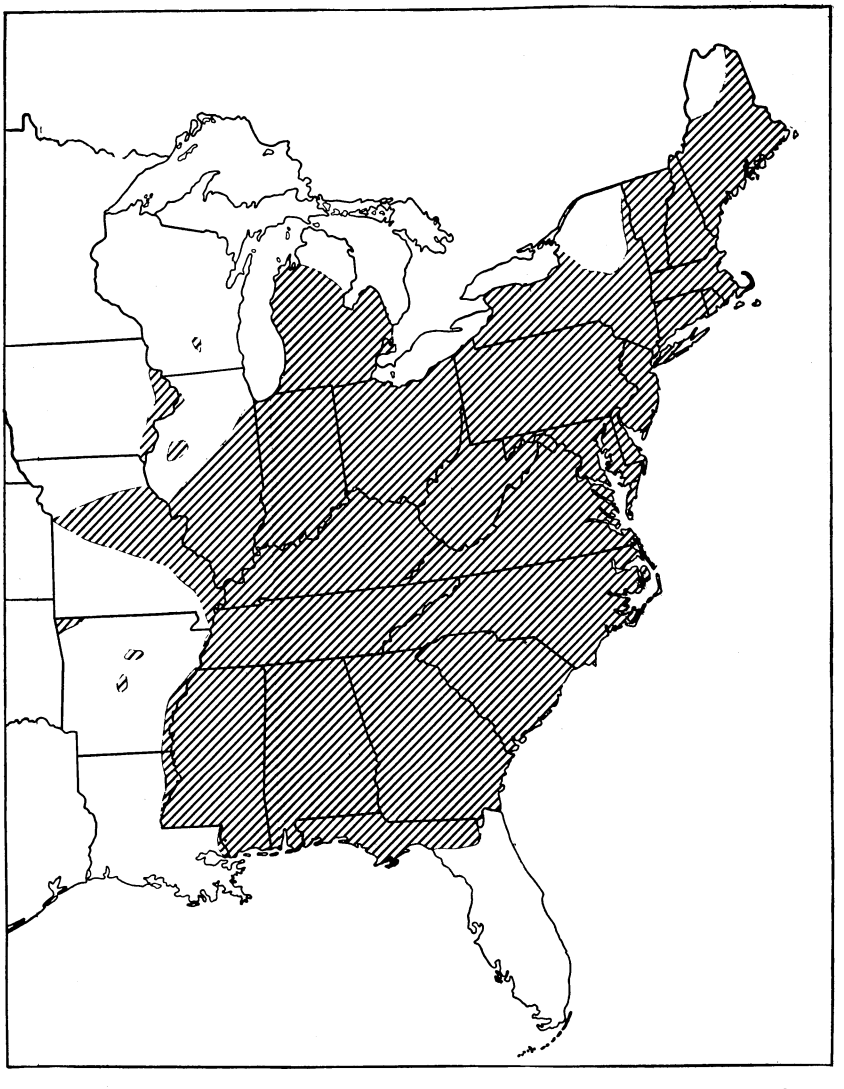


Figure 6.—**Known distribution of the Mexican bean beetle in the Eastern United States.**

In the Eastern United States the Mexican bean beetle was first discovered in Alabama in 1920. Since then it has spread to most of the important bean-growing districts of the States east of the Mississippi River, as shown in figure 6. It is also reported to be a pest in eastern Iowa, particularly in Scott and Muscatine Counties.

During 1947 an apparently isolated infestation was reported by State authorities near Madison, in Dane County, Wis. The worst damage has occurred in the foothills and valleys of the Allegheny Mountains and along the Atlantic coast from South Carolina to New York.

LIFE HISTORY AND HABITS

The beetles begin to leave their winter quarters in the spring. In the South they first appear in the bean fields late in March or early in April, while in southwestern New York they do not appear until June. At intermediate points they appear on different dates, depending on the location. In some places they are present when early beans are still small; in others, when the first blossoms appear. After feeding, usually for a week or 10 days, the females deposit their eggs.

Eggs laid early in the spring hatch in 10 to 14 days, as a rule. As the weather becomes warmer the eggs hatch in less time, in 6 or even 5 days. The young that hatch in the early part of the season develop rather slowly and may require 5 weeks to complete their growth. Later in the season, however, the development of the larvae requires an average of about 20 days. The pupal period during summer averages about 7 days. Thus the total period of development from egg to beetle averages about 33 days in midsummer.

Within 2 weeks after emerging from the pupa, the female beetle deposits eggs. Some beetles that overwintered may live for 3 months, but the majority die within 1 month. The insect reproduces rapidly; and by the time the early crop of beans has matured, the beetle has often become abundant. A maximum of three or even four generations of the beetle may occur in the Southern States, but in the North only one generation or one and a partial second are produced. In the Southwest one generation is the rule, but in some sections a second generation occurs.

The ability of the beetle to reproduce rapidly under favorable conditions is remarkable. A female may deposit an egg mass every 2 or 3 days. As many as 1,669 eggs have been deposited by one female, while the average number observed is 459.

Late in summer and early in fall the first beetles seek winter quarters, and others follow until about the first frost, at which time practically all beetles have left the fields. All stages are present in the field from spring until frost in the fall, but eggs and larvae may become scarce late in the summer and early in the fall.

The spread from the original point of infestation in northern Alabama has been accomplished mainly by flight, with the assistance of prevailing winds. The beetle is sluggish in its movements, but is a comparatively strong flier and may fly many miles. Marked beetles have, within 2 days, been captured 5 miles from the point where they were liberated. During 1921 a spread of over 200 miles northward occurred, and in 1922 a spread of over 100 miles, and the average maximum distance covered in the period 1921 to 1924 was 150 miles a year.

HIBERNATION

Only the adult beetle lives through the winter. In northern Alabama it hibernates preferably in woodlands near bean fields, where it often collects in small colonies. As many as 400 beetles have been found in one group covering an area of about 3 square feet, under pine needles and oak leaves on a well-drained woodland hillside near cultivated bean fields (fig. 7). Some may remain in the bean fields

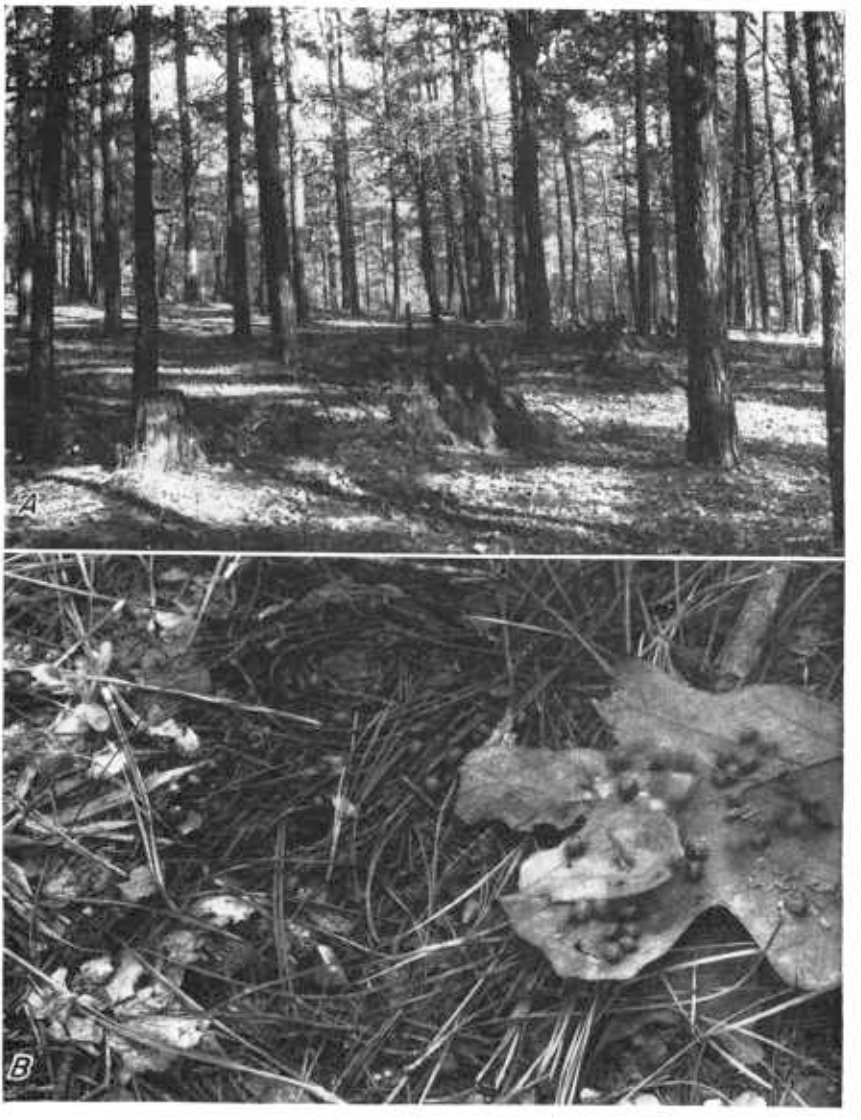


Figure 7.—Hibernation quarters for the Mexican bean beetle: *A*, Forest in which hibernating beetles were found, and *B*, litter and beetles found under brush in foreground of *A*.

and others about the field or garden under rubbish and plant remnants and along fence rows and in uncultivated land. In many sections of the North and East the majority of the beetles hibernate in such places. The beetles have been found there in the winter as far as three-fourths of a mile from the nearest bean field, but the majority stay within a quarter of a mile. In the West the beetle may fly many miles to hibernate. In the Southeastern States complete dormancy is not continuous throughout the entire winter, since the beetles move about on warm days.

FOOD PLANTS

The Mexican bean beetle is primarily an edible-bean pest, preferring the common bean, such as snap (green or string), kidney, pinto, navy, and lima beans to other kinds. The insect can reproduce successfully on cowpeas and soybeans, and injury to soybeans has become more common in parts of the South in the last few years. Ladino clover is sometimes damaged. Its second choice of food is beggarweed or beggartick, which grows wild generally throughout the Eastern States and is cultivated for hay in some sections.

NATURAL AGENCIES OF CONTROL

No internal parasite of the Mexican bean beetle had been recorded until 1922, when two native flies, *Phorocera claripennis* and *Helicobia rapax*, were found to parasitize the insect in rare instances in northern Alabama. They have never become abundant enough to be of any value.

A number of predaceous insects feed on the eggs and young larvae, and in some cases on the older larvae, pupae, and adults of the Mexican bean beetle. The most common of these in the Southeastern States is the spotted ladybird, which feeds sparingly on the eggs and young larvae. The anchor bug, *Stiretrus anchorago*, in both immature and adult stages preys on larvae, pupae, and adults of this bean beetle. The spined soldier bug attacks all stages. A few other bugs and a few beneficial ladybird beetles feed on different stages of the bean beetle, but are of little importance. The adult bean beetle at times feeds on its own eggs.

A tachinid fly parasite known as *Paradexodes epilachnae* is prevalent in some sections of Mexico, and efforts have been made to introduce the species into the United States but without success.

In the West the damage done by the Mexican bean beetle to the bean crop has varied from year to year. This has been more or less true in the East, but in many sections the beetle has been sufficiently numerous every year to do serious injury and make the use of control measures necessary. No explanation for this fluctuation can be made other than that weather conditions are probably the most important factors. Heavy rains during the spring and summer are detrimental to the insect, and larvae and adults often become mired in the soil. Extreme droughts and hot weather have been observed to act as a material check, especially if the beans suffer from lack of water. Temperature and moisture during the winter are important, and survival during the winter depends largely on these factors.

The intense heat of bright sunlight during hot periods in summer kills many larvae and pupae. When dry weather causes the bean leaves to turn upward, or when varieties of beans which have this habit are grown, many egg masses, larvae, and pupae are exposed to the heat and killed.

CONTROL WITH INSECTICIDES

What Insecticides To Use Against The Mexican Bean Beetle

Several insecticides will protect beans from injury by the Mexican bean beetle, but rotenone is the most satisfactory. The new insecticides methoxychlor, malathion, parathion, and CS–708 (Dilan) are also effective. However, rotenone is the most consistently effective material that is not hazardous to the person applying it, and does not leave harmful residues on the plants. All these insecticides may be applied in either sprays or dusts.

Rotenone is the active ingredient in derris and cube powders or extracts. For a spray use 2½ pounds of a powder containing 5 percent of rotenone, or its equivalent, in 100 gallons of water (2½ level tablespoonfuls per gallon), or sufficient extract to make a spray containing 0.015 percent of rotenone. If you use a powder that is not wettable, mix some of it with water to form a paste, and then add the remainder of the water. Do not use low-strength rotenone dusts to make sprays, for they may clog the nozzles.

For application as dusts there are a number of ready-to-use rotenone dusts on the market. They should contain 0.75 to 1 percent of rotenone unless they are fortified with other materials. Dusts containing as little as 0.25 percent of rotenone plus 0.025 percent or more of pyrethrins and 0.37 percent or more of piperonyl cyclonene, piperonyl butoxide, or *n*-propyl isome are as effective as the straight rotenone dusts and tend to give quicker knock-down of the insects.

Methoxychlor may be used in a spray at 2 to 4 pounds of 50-percent wettable powder per 100 gallons (2 level tablespoonfuls per gallon) or in a 5- to 10-percent dust. Dusts containing clay as the diluent give better results than those containing pyrophyllite. Methoxychlor is related to DDT chemically, but is less toxic to man and animals. DDT is ineffective against the Mexican bean beetle. Do not apply methoxychlor within 7 days before a harvest.

Malathion is effective in a spray at 4 pounds of 25-percent wettable powder per 100 gallons of water (2½ level tablespoonfuls per gallon), or in a 5-percent dust. Malathion should not be applied to beans within 3 days before a harvest.

Parathion may be used in a spray at ½ pound per 100 gallons (2 pounds of a 25-percent or 3 pounds of a 15-percent wettable powder), or in a 2-percent dust. **Parathion is very poisonous and should be applied only by a trained operator, who will assume full responsibility and enforce the precautions prescribed by the manufacturer. It is extremely toxic if swallowed, inhaled, or absorbed through the skin, and may cause death. Do not attempt to prepare parathion dusts, but use them ready-mixed. Do not apply parathion sprays or dusts to lima beans and dry beans within 15 days before a harvest, or to snap beans within 21 days before a harvest.**

CS-708 (available commercially as Dilan) is effective in a spray at 1 pound of 50-percent wettable powder per 100 gallons (1 level tablespoonful per gallon), and in a 2-percent dust. It should not be applied to snap beans after the pods begin to form. It should not be used on vines that are to be fed to livestock.

What Insecticides To Use When Other Insects Are Present

Several dust mixtures have been found effective when other insects besides the bean beetle are injuring beans. Where the corn earworm, the potato leafhopper, the onion thrips, and loopers are present, a dust containing 3 percent of DDT, 0.5 percent of rotenone, and 50 percent of sulfur, in talc or pyrophyllite, has been used successfully. The sulfur prevents powdery mildew, especially on late-fall crops, and is also fairly effective against spider mites. Some large-scale growers substitute 1 percent of parathion for the rotenone. Since both these mixtures leave dangerous residues, they should not be applied to snap beans after the pods have formed. (See p. 11.) Vines that have been treated with DDT should not be fed to livestock.

If it is desirable to include sulfur in sprays to be used for bean beetle control, add 4 pounds of wettable sulfur to 100 gallons of spray (2 level tablespoonfuls per gallon).

Methoxychlor and parathion will also control the potato leafhopper on beans, when used as recommended for bean beetle control.

Most insecticides are poisons. Handle them with great care. Store them in closed containers where they cannot be mistaken for food or medicine, and where children or farm animals cannot reach them. See that the containers are properly labeled.

How To Apply The Insecticides

Since both adults and larvae of the Mexican bean beetle feed on the under sides of the leaves, it is important to direct the spray or dust to these surfaces. Treating the upper surfaces only will not give good control and wastes the insecticide.

Sprays

Bush varieties of beans require 100 to 125 gallons of spray to the acre, or 1½ to 2 quarts on 50 feet of row. Pole varieties have more foliage and require larger quantities.

For best results on commercial acreages use a power or traction machine that will spray three to eight rows at a time, at a pressure of 150 to 250 pounds per square inch.

The boom should be of the proper width to match the rows, and the rows in all fields should be of the same width so that it will not be necessary to adjust the nozzles in moving from one field to another. On young plants the boom should be lowered until the nozzles are about 2 inches above the ground. As the plants grow the boom may be raised.

To reach the under surfaces of the leaves, direct the nozzles upward into the plants at a 45-degree angle, one to each side of the row (fig. 8). It is well to have a third nozzle directed downward from above the row. Place new disks in the nozzles after 10 to 15 hours of spraying, as the holes in the disks become enlarged with use.

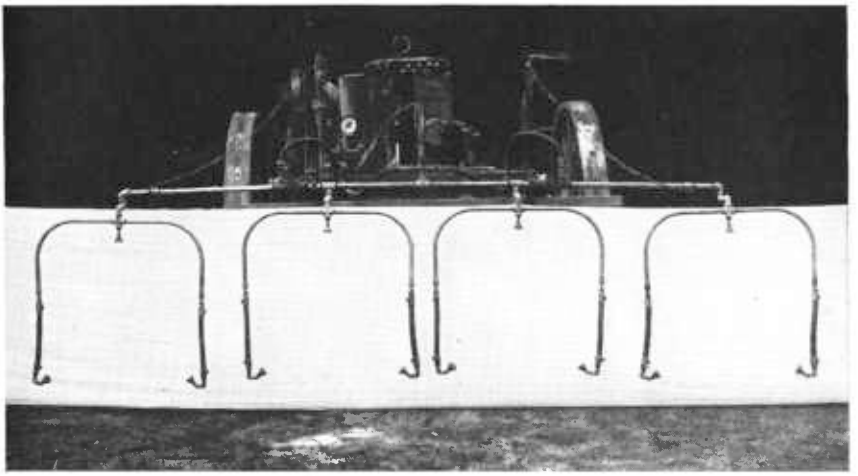


Figure 8.—A series of nozzles attached to a rigid boom.

On uneven land it is well to have sections of rubber hose in the vertical outlet pipes to make them flexible and prevent breaking as the pipes pass over rough ground (fig. 8).

The liquid in the spray tank should be agitated continuously to keep the insecticide from settling.

In gardens or small plantings compressed-air and knapsack hand sprayers (fig. 9) are satisfactory.

Figure 9.—Knapsack hand sprayers with hose and extensions to reach the under side of the leaves.

When a spotted infestation occurs on a large planting, it may not be necessary to spray the entire field. The patches that show injury may be treated with a hand sprayer to reduce the infestation and save later crops from injury.

Dusts

Dusts should be applied at the rate of 25 to 35 pounds per acre, of 1½ to 2 ounces per 50 feet of row.

For small plantings hand dusters (fig. 10) are satisfactory, but for fields of several acres power or traction machines (fig. 11) are needed.

Figure 10.—Rotary hand duster in use.

Figure 11.—A four-row tractor-drawn power duster.

Both types of dusters should be equipped with nozzles especially constructed to direct the dust upward to the under surface of the leaves (fig. 12). On large acreages, especially when it is windy,

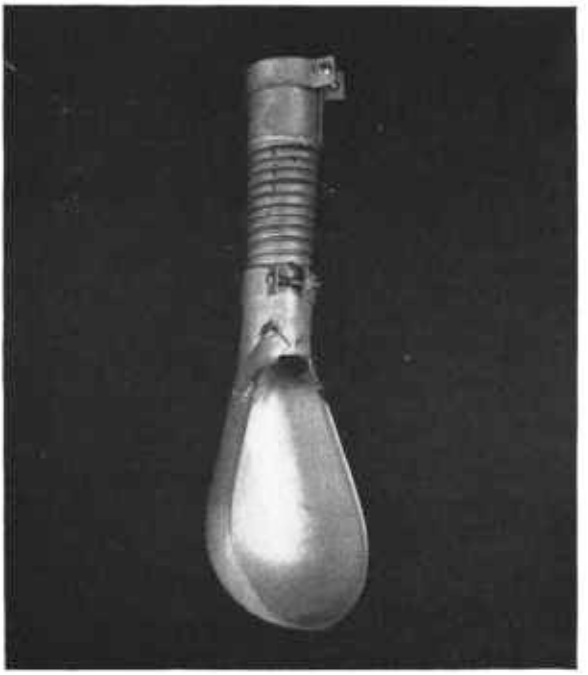


Figure 12.—Nozzle for use in dusting the under side of the leaves.

better coverage can be obtained by attaching a cloth apron 10 to 15 feet long to the machine so that it will drag behind and confine the dust around the plants.

In recent years some growers have applied dusts by airplane, but thus far ground equipment has been found more satisfactory for the control of insects that feed on the under sides of the leaves.

When To Apply An Insecticide

Apply the insecticide as soon as you notice injury to the foliage, or when you find on an average one beetle or one egg mass in about 6 feet of row. To find the beetles, give the plant a quick slap with the hand and look for them on the ground. To find the eggs, look on the under sides of the leaves.

As the plants grow, the new foliage should be kept covered with the insecticide. Therefore, make another application after a week or 10 days, especially if the beetles are abundant. On snap beans two thorough applications are usually sufficient, but lima beans grown for market must be protected over a longer period.

CULTURAL CONTROL

Another important control measure is to destroy the crop remains after the beans have been picked. By plowing the fields at least 6 inches deep, making a special effort to cover all the foliage with soil, you will kill a large percentage of all stages of the beetle. The destruction of crop remnants after harvest will reduce the need for insecticides, particularly if done on a community basis. However, the benefits will depend on the thoroughness of this treatment.

The date of planting snap beans may affect the injury that the beetles can do to the crop. However, no general rule can be made. In some sections beans planted very early are injured least; in other sections beans planted when the overwintered adults are disappearing will escape serious injury.

COMMUNITY COOPERATION

A few untreated rows of beans in a small garden can be the breeding ground of many hundreds of beetles which may spread to commercial acreages in the vicinity. Large plantings of beans may be protected and local gardeners benefited by community cooperation in the treatment of all garden beans in the neighborhood.

Many canners supply insecticides and hand sprayers to growers of small plantings at cost and give advice as to their use, thus contributing to the control of the beetle for the benefit of the entire community. In many sections similar assistance is given by the farm bureaus in cooperation with the county agents.

U. S. GOVERNMENT PRINTING OFFICE: 1953

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 10 cents